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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,547	11/21/2003	Takehiko Makita	31869-198826	7976

26694 7590 10/16/2006

VENABLE LLP
P.O. BOX 34385
WASHINGTON, DC 20043-9998

EXAMINER	
DEO, DUY VU NGUYEN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 10/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/717,547	MAKITA ET AL.	
	Examiner	Art Unit	
	Duy-Vu N. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 August 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3, 5, 6, 8, 10, 11, 13, 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art and Moustaka (US 5,847,397).

Admitted prior art, pages 1-3 of the specification, describes a method for forming HEMTs comprising: removing part of GaN (second compound semiconductor) by dry etching to partially expose a surface of the A1GaN. Unlike claimed invention, admitted prior art doesn't describe nitrogen plasma treatment step to recover damage due to nitrogen vacancies arising in the expose A1GaN surface. Moustakas teaches a surface treatment method for a compound semiconductor comprising treating the surface with a non-etching nitrogen plasma to reduce the formation of nitrogen vacancies (claimed recover from the damage due to nitrogen vacancies arising in a surface of the compound semiconductor) (col. 5, line 39-48). It would have been obvious for one skilled in the art in light of Moustaka to treat the compound semiconductor with N2 plasma because it reduces the formation of nitrogen vacancies (col. 5, line 39-48),

which is a problem recognized by one skilled in the art at the time of the invention (page 3 of the specification).

Referring to claim 10, the conventional method for forming HEMTs further comprises: forming the A1Gan layer on a substrate and a GaN layer on the A1Gan layer; forming a first and second main electrode on the A1Gan layer; annealing the partially exposed A1Gan layer; and forming a gate electrode on the exposed A1GaN (page 2 of the specification).

Referring to claims 16-21, Moustaka doesn't describe the nitrogen plasma treatment temperature is at at about 40 degrees C. or less than 100 degree C; however, he shows the temperature can be treated at a big range 270-600 degree C (col. 5, line 37, 44-45). Therefore, in the absent of unexpected result, one skilled in the art would find it obvious to use the low temperature such as less claimed 100 degree C because it would save time and reduce cost (from heating the substrate) and as a result would increase the production yield.

3. Claims 2, 7, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior and Moustaka as applied to claims 1, 5, 10 above, and further in view of Lee et al. (US 6,762,083).

Referring to claims 2, 7, 12, Moustakas doesn't describe a plasma treatment for the compound semiconductor using a ICP (claimed ICP RIE) (col. 2, line 39-45). It would have been obvious for one skilled in the art to any apparatus that are available and known in the art as shown here by Lee as long as it can provide plasma for the treatment process with a reasonable expectation of success.

4. Claims 4, 9, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art and Moustaka as applied to claims 1, 5, 10 above, and further in view of Gilbert et al. (US 2002/0072223).

Referring to claims 4, 9, 14, cleaning semiconductor with pure water is known to one skilled in the art in the process-manufacturing device as shown here by Gilbert in order to remove contamination on the wafer (paragraph [0045]).

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 16-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. It is not clear where in the specification teaching of the nitrogen plasma step is carried out at a temperature of less than 100 degree C.

Response to Arguments

7. Referring to applicant's argument that the admitted prior art doesn't describe that dry etching causes nitrogen vacancies to any surface, page 3 of the specification describes Hashizume's report in the paper "'Discrete surface related to *nitrogen-*

vacancy defect on plasma-treated GaN surfaces". The plasma-treated process would certainly include dry etching.

Referring to applicant's argument that there is no suggested in the admitted prior art and Moustakas on how to get rid of the nitrogen vacancies that already exist or recover form associated defects or how to eliminate nitrogen vacancies once they have formed, as described in page 3 of the specification, Hashizume shows that the surface of a nitrogen-containing compound semiconductor layer can be treated with nitrogen plasma without causing nitrogen-vacancy damage and Moustakas teaches using nitrogen to reduce the formation of nitrogen vacancies. These references suggest that nitrogen has been used to deal with the problem of nitrogen vacancies. It is obvious that to treat the *nitrogen* vacancies, one skilled in the art must use *nitrogen*, either to prevent it or correct it.

Once the nitrogen vacancies are corrected, the damages associated with the nitrogen vacancies would certainly fixed.

Referring to applicant's argument that a teaching of 40 degrees C. would support the phrases less than 100 degrees C, the specification doesn't show that from 41-100 would work at the time of the application was filed, only at substrate temperature of 40 degrees C. It only describes the substrate temperature, but doesn't describe anything about the T of nitrogen plasma step, because the plasma T would be different from the substrate T.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duy-Vu N. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Duy-Vu N Deo
Primary Examiner
Art Unit 1765

10/12/06